SCIENCE

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NEW YORK, JUNE 24, 1892.

AIMS OF LABORATORY TRAINING.[1]

BY CHARLES F. MABERY.

It is only within a comparatively recent period that the chemical laboratory has attained the prominent position it now occupies in colleges and schools of science. Indeed, in its present development, with facilities for practical study in inorganic and organic chemistry, both elementary and advanced, thirty years ago there was not a single laboratory in this country, and few elsewhere. Probably the earliest attempt in this country to give systematic laboratory instruction, to classes of any magnitude, was made in 1865 at the Massachusetts Institute of Technology. Analytical chemistry had previously been taught to a limited extent in a few institutions for the training of analytical chemists. In organic chemistry, or chemistry of the carbon compounds, instruction was first given by lectures and laboratory work in 1872 at Harvard College. On account, it may be, of the slight attention that technological and applied chemistry has received in this country as compared with Europe, few courses of study at the present date, even in the most prominent schools of science, include practical training in this subject.

In speaking of the functions of the modern chemical laboratory, it should be considered as an important factor in liberal education as well as a means of preparation for scientific pursuits; and we shall doubtless find our attention fully occupied in describing the principal aims of a laboratory devoted to pure and applied chemistry, without including the no less important work of laboratories in the special fields of agricultural, medical, biological, and sanitary chemistry. That a thorough training in general and descriptive chemistry should now form an essential feature in a liberal course of study, probably no one will venture to doubt. To the man of business, a knowledge of the composition and properties of materials is important as stock in trade. In the practice of law, decisions often involve a consideration of chemical changes as well as the composition of various substances. To men engaged in literary pursuits, in political life, or in the ministry, questions are frequently presented that require for their intelligent consideration a certain knowledge of chemistry. But especially to men engaged in any scientific pursuit, a good knowledge of substances, their occurrence, properties, and relations is indispensable. A chemical laboratory is therefore called upon to provide for each student broad and thorough training in the elementary principles of chemical science, including the composition and properties of matter. As to the best method for such instruction there may have been certain differences of opinion, but I think it is now universally conceded, that, while it is essential that the student should commit to memory important facts and principles as they are presented to him at the lecture table, it is in the laboratory that he recives the discipline of the hand and eye, and in methods of reasoning, that enables him to acquire the true spirit of scientific thought, and to retain a remembrance of facts that otherwise he would soon forget.

[1] An address delivered at the opening of the new chemical laboratory of the Case School of Applied Science, May 12, 1892.

As a foundation for more advanced study in science, especially in the various branches of chemistry, the analytical laboratory is an important adjunct. It is here that the student should not only receive most careful training in the methods of correct manipulation and close attention to the details of analytical processes, but he must acquire familiar acquaintance with the many analytical operations that he will be called upon to perform in the practice of his profession. It is unfortunately true that students are often content with the acquisition of sufficient knowledge to enable them to obtain positions as analytical chemists. Such training, however, is inadequate for the demands of the present day, since chemists are frequently called upon to undertake problems in technical chemistry that require broader qualifications. A very considerable part of manufacturing operations in industrial chemistry are based upon the properties and reactions of the carbon compounds, and any course of instruction in applied chemistry must be regarded as seriously deficient if it does not include thorough discipline in organic chemistry.

In a preparatory course of four years in chemistry, then, if thorough drill in the elementary chemistry of the first year is followed by instruction in analytic and theoretical chemistry, extending through two years, with an equally extended course on the carbon compounds, the student will be prepared in the fourth year to appreciate a comprehensive, practical course in industrial and applied chemistry. Incidentally, in the more advanced subjects, he should form at least some slight acquaintance with methods of study and investigation outside of the ordinary routine. Indeed, ability to undertake original problems such as are constantly presented for solution in industrial operations has a pecuniary value that is well recognized. It is in fact the basis of many commercial enterprises.

With this brief outline of what may be regarded as the principal aims to be kept in view in the management of a laboratory, perhaps it will be of interest to examine into the causes that have led to the recent development of laboratory methods. Although, as already explained, these methods have been largely developed within thirty years, it should not be understood that the foundation for them has been laid within this period. On the contrary, a knowledge of certain processes involving chemical principles conducive to the comfort and convenience of mankind is older than history itself. Metallic implements and coins of the bronze age indicate that the prehistoric races were acquainted with methods for the reduction and alloying of metals. That the ancient Egyptians understood the preparation of indigo and its application to dyeing is shown by the presence of tissues dyed with this substance on mummies taken from their oldest tombs. The extraction of turkey-red from madder was early known to the Egyptians, Persians, and Indians, and later to the Greeks and Romans. It would be impossible in a limited space to describe the numerous discoveries of the early ages, or the multitude of facts collected by the alchemists in their endeavors to discover the philosopher's stone which would enable them to transform the baser metals into the nobler, and in their search for the *elixir vitæ*, a panacea for all the ills of man. Notwithstanding this vast accumulation of facts, no efforts were made toward a systematic arrangement

for the basis of a science, until late in the last century the foundation of chemistry as an exact science was established mainly through the labors of such men as Priestley, Scheele, Cavendish, and Lavoisier. To the latter especially is honor due for introducing the balance as a means of conducting chemical operations on a quantitative basis. The first great event of this period was the discovery of oxygen gas as a constituent of the atmosphere by Priestley, and it was soon followed by a determination of the composition of water, for which Cavendish receives credit. The classic experiment of Lavoisier, in which he ascertained the quantitative proportion of oxygen in the atmosphere, was the beginning of definite ideas concerning the composition of matter. The earlier part of the present century was honored by the brilliant researches of Sir H. Davy, Gay Lussac, Dalton, Berselius, and other investigators, which contributed so largely toward the foundations of modern chemistry, and which resulted in the law of gaseous combination of Gay Lussac, the laws of definite and multiple proportions of Dalton, and the law of Avogardro relating to the molecular composition of matter. These deductions were followed by many theories, which were later modified or replaced by others as new facts were discovered, until there has resulted a substantial system of nomenclature and theoretical principles, sufficient at least for working hypotheses, and sufficient to explain the greater portion of well-authenticated facts. Of recent contributions to chemical theories probably there are none of greater service in classification and arrangement, or that afford better opportunities for speculative research, than the periodic law which we owe to Newlands, Lothar Meyer, and Mendelejeff.

The application of chemical principles seldom precedes a good understanding of the principles themselves. Operations may indeed be carried on in a haphazard fashion according to empirical rules, but the results are apt to be unsatisfactory. We should therefore expect to see the development of technological chemistry following in certain lines the general advancement in scientific knowledge, and it is not difficult to understand the marvellous growth in applied chemistry during the last fifty years. Probably the most important branch of chemical industry that has ever been created is the manufacture of sulphuric acid. There is scarcely a commercial process involving chemical changes that is not dependent directly or indirectly upon the use of this acid; and, while at present the yearly production amounts to several million tons, it is only one hundred and fifty years since the lead-chamber process was first devised, and only one hundred years since Chaptal introduced the improvements for the continuous process now in use. A scarcely less important branch of industrial chemistry is that of bleaching, which resulted from the application by Berthollet, in 1788, of the properties of chlorine, already discovered by Scheele, in 1777, to destroy certain coloring principles without injury to the vegetable fibres. The manufacture of illuminating gas, which is such an important factor in modern life, was first attempted in 1798, and outside lighting with gas in 1812.

Many other illustrations might be presented to show how recent is the growth of technological chemistry, but it is in the domain of organic chemistry that the development has been most wonderful. Here is a quantity of urea, which, as everyone knows, is a constituent of various fluids in the circulation of animals. In 1828 the illustrious chemist Woehler obtained this substance simply by heating ammonium cyanate, and it was the first instance of the artificial preparation of a substance of organic origin. This was the beginning of synthetic organic chemistry. In attempting to illustrate what has since been accomplished in this field, we will select as a single example the multitude of substances that have been obtained from coal-tar, a bye-product in the distillation of coal for illuminating gas, and we will ask your attention to this chart, which shows a graphical arrangement of many of these compounds in their genealogical descent from coal.

With this brief review of the development of the chemical laboratory and the purposes of laboratory instruction, a question will doubtless arise as to its future efficiency in scientific education, and especially as to the part it will be expected to perform in promoting the material interests of society. While the utilitarian principle of the latter aim would naturally become the more important feature of laboratory training, in the school of science it should never be forgotten that whatever of mental culture or discipline the student receives must be derived from the courses of study that are intended as a preparation for his special vocation. Constant vigilance is therefore necessary to restrain the natural disposition of the average student, which leads him to avoid all possible mental exertion and to concentrate his energy upon the mechanical side of routine laboratory practice.

The elementary courses of the freshman year constitute the formative period, and if correct habits are early established, the more advanced work of later years will be undertaken in the true spirit of scientific study. But if, on the other hand, the student falls into careless or indifferent methods, it is rarely that he recovers from them. Concerning the preparation that must be provided to meet the demands of the future in applied chemistry, the foundation will be chemical analysis. No process involving chemical changes can be conducted intelligently and economically unless it is carefully controlled by a complete knowledge, not only of materials employed and valuable products obtained, but also of slags, gases, and all waste products. In the great smelting works in Europe ores are purchased for everything of value they contain. If a gold or silver ore contains, for example, arsenic, antimony, nickel, zinc, and bismuth, in appreciable quantities, the process of smelting will have due reference to the separation of every one of these constituents. In America, with enormous stores of the richest ores and supplies ready at hand, miners and manufacturers have found the principal constituents too profitable to waste time in the recovery of bye-products. Many a western ore-dump will richly repay for reworking to recover what at first was thrown aside as unprofitable material, and in several directions this fact is even now receiving attention. If the price of coal in Cleveland was twelve dollars per ton, as it is in Switzerland, instead of two dollars per ton, the price now paid here, instead of an atmosphere laden with valuable fuel, the process of combustion would be controlled so that nothing but legitimate constituents of smoke could escape. Important changes in this respect, however, are in progress, and manufacturers are appreciating more fully the importance of accurate scientific knowledge and the services of skilled analysts.

Allusion has been made to a higher field for the employment of educated chemists than that of analytical chemistry, and it is one in which we may expect extensive developments. It is a familiar fact that many materials in daily use can only be obtained by importation from other countries; but the immense quantities of certain manufactured products annually imported may not be generally appre-

ciated. Notwithstanding our abundant supplies of crude materials, with cheap fuel in unlimited quantities and a ready market with an increasing demand, we continue to pay enormous sums for imported products that should be produced at home. The causes of this condition of affairs should not be far to seek. That it is not from lack of enterprise is evident from the readiness with which novel schemes are able to secure financial support. It is generally understood that the principal hindrance to home production is the high cost of labor as compared with prices paid in Europe, and it is sometimes hinted that it is in part due to a lack of thoroughly trained scientific specialists. As regards the higher cost of manual labor here, it would seem that the difference must be less than the cost of importation, which includes the tariff. If this state of affairs is in any degree due to a dearth of scientific men capable of conducting manufacturing operations, and the scientific schools cannot produce such men, truly the schools are not taking advantage of their opportunities. That such a feeling exists with some manufacturers is evident from the fact that they send abroad for their chemists. Whether better talent is secured than can be obtained at home may well be regarded as an open question. Perhaps a still broader view of the situation is necessary; it may be that our invested capital is too busy in securing lucrative returns from business enterprises connected with the development of our natural resources to undertake operations that require skilful management to yield even a fair profit, and that we are therefore better content at present to pay importers' prices than to manufacture ourselves. If this be true, we must wait with patience for a change that will surely come.

Altogether the outlook for the immediate future is encouraging. In several directions the manufacture of chemical products has begun, and others will follow. There are certain lines along which rapid development may evidently soon be expected, and one of the most promising is sal-soda. Until quite recently the Le Blanc process, which was invented in France to manufacture soda-ash when the supply from natural sources was largely cut off during the French Revolution, has supplied the world since early in the present century. In utilizing all bye-products the great Le Blanc works of Europe have been able to produce soda-ash at a trifling cost. A Le Blanc plant has never been established here, and probably one never will be. Such a plant requires an immense capital, and, besides, a combination of coal, salt, and limestone, that can be found close at hand in but few localities. Within a few years another method, known as the ammonia-soda process, has been put into operation in Europe. The first-cost of a plant for this process is not large, and since it furnishes a purer product than the Le Blanc method, it will probably supply a considerable portion of the sal-soda of the future, especially in this country. The newer method has the especial advantage that it forms bicarbonate of soda direct and very pure. Two plants for this process have been erected here, one of which has been in operation at Syracuse, N.Y., for several years, and the other has recently been erected in Cleveland.

As another illustration of the possibilities in store for us, I will ask your attention to this lump of porcelain clay that came from a large deposit in Maryland, and there are large deposits in other localities. This clay is quite as pure and quite as well adapted for the manufacture of the finest porcelain as any in use in France or Germany. Of the other materials necessary in this industry, this quartz and this feldspar are just as pure, and we have extensive deposits of both. We have also cheap fuel, and yet we pay a tariff of forty-five per cent *ad valorem* for English, French, and German porcelain, besides paying the potter a fair price for his labor. All such porcelain as we have before us is made at the Royal Berlin Porcelain Factory, where it has been shaped, baked, and decorated by father and son for one hundred and thirty years. Who will venture to predict the possible developments in our own country during an equal period in the future? At present we make certain kinds of ware, but no one needs to be told the difference between it and the elegant Dresden, Sevres, or Royal Worcester.

A single additional example will doubtless suffice to show what we may reasonably expect in the future. The production of artificial dyes and colors from coal-tar has assumed enormous proportions since it was begun thirty years ago. Graebe and Liebermann invented the process for the preparation of artificial alizarine in 1869, and in 1880 it was estimated that this invention had saved $20,000,000, the additional cost if the same quantity of this dye-stuff had been obtained from natural madder. At present there are twelve large alizarine factories in Germany and England, but not one in the United States. The annual production of anthracene paste, the source of alizarine, is three thousand tons; but not a single pound is manufactured here. Of the total output of alizarine, 2,154,930 pounds, valued at $358,862, are consumed in this country. The estimated daily production of aniline and similar dyes, in England, France, and Germany, is estimated at 35,000 pounds, and in 1890 importations into the United States were valued at $1,787,558. Naphthalene, another constituent of coal-tar, until quite recently was practically a waste product; but thorough study of the naphtols, their sulphonic acids and other derivatives, has revealed the beauty and permanency of the numerous colors that may be derived from them, and they are now produced in considerable quantities. One factory in this country holds patents for the preparation of colors from naphtol-sulphonic acids. Yet with this condition of our manufactures we have the largest deposits of coal in the world, and the products of its distillation are collected in immense quantities. These products have even been sent abroad to be manufactered into colors and returned to us for consumption at a very high cost.

A clearer insight into the extent of our importations of products that might be produced at home may be given by a review of quantities and values selected from the Annual Report of the Bureau of Statistics on Foreign Commerce and Navigation for the year ending June 20, 1890: —

	Pounds.		Values.
Potassic chlorate	2,442,775		
" dichromate	1,166,001		
" ferrocyanide	849,070		
Total soda, including ash, salt-cake, bicarbonate	394,531,050		$5,099,227
		Duty	$1,688,071
Sodic hydrate	79,461,923		
Kaolin (tons)	27,136		
Total clays (tons)	336,488		
China and Pottery			$4,791,474
Glassware			$7,351,570
Glucose	911,573		
Iron, steel, and manufactures of the same			$43,498,074
		Duty	$18,384,175
Carbolic acid	522,237		
Oxalic acid	1,973,050		
Alizarine, artificial and natural	2,155,020		
Manganese binoxide	22,587,848		
Milk-sugar	320,684		
Alum	6,822,065		
Ammonium salts	6,911,228		
Coal-tar colors not enumerated			$1,313,771
Dextrine	9,188,566		
Glycerine (Crude)	11,811,308		
" (Refined)	210,545		
Lead acetate	19,000		

These illustrations are doubtless sufficient to indicate the extensive field that is open for the development of technological chemistry; and, with all deference to the aid that should be expected from the study of chemistry in the various systems of liberal education, they seem to afford convincing evidence that, in its highest efficiency, the chemical laboratory of the future should include the promotion of industries that depend upon the application of chemical principles.

NOTES AND NEWS.

THE railway which is at some time or other to traverse the African continent has been opened as far as a point near Cazengo, 140 miles from the starting-point, St. Paul de Loanda.

— A South African and International Exhibition will be opened at Kimberley in September. The processes of winning diamonds and gold will be shown; the machinery department will contain a large variety of machinery employed for mining and agricultural purposes; and the agricultural interests of the colonies and neighboring states will receive special attention.

— The British Medical Association, says *Nature*, will hold its sixtieth annual meeting at Nottingham on July 26, and the three following days. Mr. Joseph White, consulting surgeon of the Nottingham General Hospital, will preside. Addresses will be given in medicine by Professor James Cumming of Queen's College, Belfast; in surgery by Professor W. H. Hingston of Montreal; and in bacteriology by Dr. G. Sims Woodhead of the Research Laboratory of the Colleges of Physicians and Surgeons, England. The scientific work of the meeting will be done in ten sections.

— Through the courtesy of his friends, the editors of *The Scottish Geographical Magazine* have had an opportunity of perusing a diary by Mr. F. J. Matthew of a ride of 1,000 miles through a little-known part of the territory of the Argentine Republic. On Oct. 5 he started from Buenos Ayres by train, and reached Mendoza on the 7th. Thence he travelled, partly by coach, partly on horseback, to San Rafael, a distance of 210 miles. Having collected a store of provisions, the traveller set out on Nov. 16, with six mules and a man, and, crossing the river Diamante, took a westerly direction towards the Cordilleras, the route being through very beautiful scenery, for the Andes were not far distant, and the second night was passed at an elevation of 4,450 feet above sea-level. On the third day the river Atuel was reached, and two or three days later Mr. Matthew rested at the *estancia* of an English doctor living in Mendoza, where 15,000 sheep and 6,000 or 7,000 head of cattle are fed. Thirty miles from this *estancia* lies the lake Llancanelo, a narrow sheet of water several leagues in length. Two years ago part of it dried up, leaving a flat expanse of smooth sand nine miles across. Seen from the middle, this sandy plain has a bright-blue, glassy appearance, and counterfeits water wonderfully. The lake is fed by two streams, but has no visible outlet. It is said to be drained by a subterranean stream. At any rate, in the dried bed are to be seen several of those funnel-shaped depressions common in the Karst formation; their sides are encrusted with salt. The country around is wild, and the climate cool, the altitudes at which the camp was pitched being 5,600 to 5,800 feet. Game is plentiful. Herds of guanacos were often met with, and pumas are so numerous that horse-breeding is impossible, as they kill all the foals. Near Chacaico, where Mr. Matthew stayed a month, he observed eagles, condors — which are very destructive among the calves and sheep — rattlesnakes, otters, and a variety of chinchilla (probably the Alpine viscacha, *Lagidium Peruanum*). At Agua Nueva, twenty-one miles east of Chacaico, a large quantity of stock — horses, cattle, sheep, and goats — is fed by squatters, who pay a small rent for the use of the *camp* or run (*campo*). The pasture is excellent, but last year locusts played great havoc among the more tender grasses. The return journey was made across the Atuel and Salado rivers, and over the Central Pampa to Trenque Lauquen. The country, at first rocky, changed to level pampa of poor soil covered with prickly shrubs. Rain came down in torrents and swelled the rivers, so that they were difficult to cross. Water, which is scarce even among the mountains, is often not to be procured during a ride of fifty miles. Mosquitoes were troublesome, and at one camp a swarm of locusts obliged the traveller to pack up and move on. In the province of San Luis woods began to appear, and improved the landscape. Near Cochico is a series of shallow lakes of brackish water, studded all over with dry, barkless trees. For two or three days Mr. Matthew rode through dense woods, and then entered the grassy pampa, where *estancias* were more numerous, and the track well worn. Nothing but grass, reaching up to the knee of a man on horseback, can be seen the whole day long. Most of it is *pasto amargo* (bitter grass), and the sheep do not seem to thrive on it. The sheep are of different breeds — Lincoln, Merino, Rambouillet — and the cattle mostly crossed shorthorns. Trenque Lauquen is on a railway, by which Buenos Ayres can be reached in twelve hours.

— A new application of the stems of the larger-growing species of bamboo has recently been adopted in China for the manufacture of small trays and ornamental articles for export to Europe. It is known in China as bamboo sheeting, and it is said to be carried on at present only to a limited extent at Wenchow, where, notwithstanding that it is quite a new trade, about ten firms are now engaged in it. The process adopted is as follows: A length of bamboo is cut off, and then pared with an axe till it is of the thickness required. It is next planed with a spokeshave, and the thin cylinder so obtained is slit up, so that, on being opened out, it forms a sheet. A number of these cylinders, placed one inside the other, are immersed in boiling water for a few minutes, to render them flexible, and they are then unrolled and flattened out, by being subjected to pressure under heavy stones. These sheets are sometimes used for making fretwork and carved screens, fans, etc.; and the small, pale straw-colored pin-trays, for toilet tables, which appeared in the London shops last season, are apparently made from this specially prepared bamboo. It seems to adapt itself extremely well for moulding into many forms, and might be made available in this country for various kinds of veneering. The bamboo now appears to be the *Dendrocalamus latiflorus*, and specimens of the sheeting, and articles made from it, may be seen in Museum No. 2 of the Royal Gardens, Kew, says *The Journal of the Society of Arts*.

— The first sunshine recorder was the invention of Mr. John C. Campbell of Islay, and consisted of a hemispherical bowl, in which a spherical glass ball stood on a low pedastal. As the sun passed across the sky, its rays, concentrated by the ball, burned a groove in the side of the bowl. With this instrument the amount of sunshine during six months was roughly recorded, and the character of individual months was fairly shown, but the grooves of two successive days could not be distinguished from each other, the change in the sun's declination being very slight. Slips of cardboard were afterwards substituted for the wooden bowl; and in the present form of apparatus, devised by Sir G. G. Stokes, according to *The Scottish Geographical Magazine*, three brass grooves, concentric with the spherical lens and adjusted for the latitude, hold the cards for summer, winter, and the equinoxes, respectively. The cards are changed daily at sunset. This instrument is not without defects. When the sun is low it ceases to act, and at all times the slightest film of cloud, hardly visible to the eye, is sufficient to check the burning power of the sun's rays. Photographic processes have been devised by Mr. Jordan, Professor M'Leod, and others, but they are less easily managed. The Stokes-Campbell instruments have been in use since 1880, and the Meteorological Office has issued a report on the sunshine recorded during the years 1881–90. The sunniest spots in the Kingdom are the Channel Islands, which enjoy sunshine during 39.9 per cent of the time the sun is above the horizon in the course of the year. Falmouth shows the next highest record, 35.7 per cent, and along the whole coast of England from Milford Haven to Yarmouth there is no great variation. The coast naturally receives more sun than inland districts, where clouds are formed by the hills, and in towns the percentage is low owing to the smoke. As regards the monthly means, it is found that in Jersey alone does the sunshine ever attain to half the amount

possible; 52 per cent is the value for May and 55 for August. Geldeston, in Norfolk, follows with 48 per cent, and the eastern coast as far north as Aberdeen is decidedly sunny. Ireland and the west of Scotland have persistently cloudy skies in summer and early autumn but in late autumn Ireland is particularly favored by the sun. On the other hand, from some unexplained cause, there is a deficiency of sunshine in Jersey during November. The sunniest month in the ten years was May, 1882, when thirty-three stations registered at least 50 per cent. June, July, and August, 1887, were also very bright. The highest monthly amount entered, 68 per cent, was recorded at Falmouth in June, and in Jersey in August of that year.

— Bulletin No. 30 of the Kansas Experiment Station reports a well-planned experiment, designed to show whether the old practice of shelling off the butts and tips of ears of seed-corn was a rational one. In this experiment five duplicate plants were planted with seed from different parts of the ear. This question has also been under investigation for several years at the Ohio Experiment Station. There is a remarkably close agreement between the average yields from butts and middles in Kansas and Ohio, but this agreement does not hold out when it comes to the tips. The experiment is being continued at the Ohio station, as they are still in doubt whether the irregularities in yield observed are due to the seed or to the inevitable variations in the soil of different plats, a factor of error which can only be overcome by many repetitions of the test. In view of the results thus far indicated it may be well to call attention to the possibility of the middle of the ear failing to dry out in some seasons as well as the ends, in which case it would be less valuable instead of more valuable for seed.

— The next meeting of the International Congress of Orientalists will be held at Lisbon, from Sept. 23 to Oct. 1 of the present year, under the patronage and chairmanship of the King of Portugal. All societies and individuals will be considered members of the congress upon the payment of 25 francs. All applications should be sent to the Secretary of the Geographical Society, Hotel de la Société, Lisbon, Portugal. The scientific programme will embrace the following sections: Summary of Oriental Researches since 1891; Semitic Languages, except Arabic; Arabia and Islam; Assyriology; Palestinology; The Aryan Languages, including, 1, Sanscrit and Hindustanee, 2, Pahli (language of Ceylon) and Buddhist, 3, Iranian and Zoroastrian; Africa, with the exception of Egypt; Egyptology; Central Asia and Dardistan; Religions Compared (Mythology, Mythography, Philosophy, Laws, Oriental Sciences, History, etc); Languages Compared; Encouragement of Oriental Studies; Indo-Chinese Studies; Chinese Studies; Japanese Studies; Dravidian Studies; Malay Archipelago and Polynesia; Questions for Explorers; Ethnographic Philology and Migration of Races; Art, Archæology, Numismatics, and the Industrial Art of the East; The Scholars and the People of the East; Oriental Philology in Commerce, etc. (with subdivisions for the different modern Oriental languages); Anthropology, The Science and the Natural and Artificial Products of the East; The Orient and America; The Orient and Portugal; Special Section for the Phillipine Islands; Exhibition of Books and Objects to Illustrate the above Sections.

— In the course of a journey through British New Guinea, in January last, says the Proceedings of the Royal Geographical Society, the indefatigable Administrator, Sir William Macgregor, examined and described several remarkable islands, which he shows to be almost certainly ancient atolls that have been elevated by steady horizontal uplift. The island generally known as Kitava (but called Nowau by the natives) has an area of about five or six square miles. It appears to be surrounded by a fringing reef. Nearly all round the island there is a low and slightly sloping margin covered with trees, and about a quarter of a mile wide. This terminates inland in a steep coral wall, which rises abruptly to the height of 300 or 400 feet, and is covered with forest. Shells in the coral point to a comparatively recent upheaval. From the crest of this wall the land dips gently to a plateau from 50 to 100 feet lower, which occupies the centre of the island. The plateau is undulating, has a rich chocolate soil, and being protected from wind by the raised rim, whilst subject to a copious rainfall, it is very fertile. All the people live in the hollow, so that from the sea the island seems to be uninhabited. The central hollow is drained by filtration through the cracked and porous coral rock. Kwaiawata Island, which is from one and a half to two miles in diameter, showed precisely the same form and structure, and in Gawa Island there is a still more perfect instance of a raised atoll. The coral wall in the last instance rises so abruptly to the height of about 400 feet that part of it has to be climbed by ladders, and the plateau representing the old lagoon is nearly 100 feet below the level of the edge. Iwa, another adjacent island about a mile in diameter, is of the same kind, only the gently sloping border has been worn away, and the coral cliff meets the sea nearly all round. These remarkable islands merit more detailed study by a geologist on account of their obvious bearing on the theory of coral formations, and their resemblance to the upraised reefs of the Solomon Islands. It would appear that the area of post-tertiary elevation which Dr. Guppy demonstrated in the Solomon Islands must be extended to include the border islands of New Guinea as well.

— Brick tea has usually but little to commend it, as it is known to be composed of the sweepings and dust of the Chinese tea factories. Its chief market is Russia, which took from China last year 2,005,548 pounds, one-half the usual export, due, it is said, to the scarcity of tea dust. A new article in tea has, however, according to the *Journal of the Society of Arts*, recently sprung up in China, in the form of tablet tea, which appeared in the trade returns of Kiukiang for the first time last year, machinery having been erected there for its manufacture, and the quantity shipped from that port was 493,398 pounds. Tablet tea is made from the very best quality of tea dust. It is formed, by pressure alone, into small cakes, which are perfectly hard and solid, and somewhat resemble chocolate in appearance. The material is not, like brick tea, moistened with steam, before being compressed, and the flavor is not in any way impaired by the process of manufacture.

— An experimental voyage, which, though its main object is commercial, is not without interest of a more general kind, is about to be undertaken by Captain Gray of Peterhead, the well-known Arctic whaler. Captain Gray is of opinion that the value of the Antarctic Seas as a whaling-ground has never been properly tested, and he has, according to the Proceedings of the Royal Geographical Society, succeeded in raising the capital necessary for prosecuting an experimental voyage with a couple of vessels of some 400 or 500 tons register, propelled by auxiliary engines of 70 or 80 horse-power nominal. A statement issued by Captain Gray and his brother contains numerous extracts from the literature on the Antarctic regions, as evidence that there is a reasonable prospect of developing a new and important industry in the Southern Seas. "We have," say the authors of the statement, "been induced to select that region in the Antarctic area lying between the meridian of Greenwich and 90° west longitude as the locality in which, in our opinion, the fishery we have projected might be prosecuted with the greatest advantage. It was explored by Captain Ross in his last voyage, and has been reported by him to be frequented by the right whale in great numbers. It is besides accessible from Britain by a direct route lying between the continents of America and Africa, not exceeding 7,200 miles in length, or a two months' passage, at an average speed of five knots per hour. We think that the month of December, corresponding to that of June in the northern hemisphere, which has generally been chosen for the commencement of the work of exploration in the Antarctic Seas, is too late, and that it might be prosecuted with advantage at least a month earlier. We should therefore recommend that, on the event of vessels being fitted out to prosecute the fishery in the South Polar Seas, they should leave the country in August, and reach the whaling-ground by the end of October, which would give at least four months, viz., November, December, January, and February — ample time for completing their cargoes, and enable them to reach Britain again in May, thus leaving from three to four months for discharging and refitting before sailing on a new voyage in August." As Baron Nordenskjöld's son is to accompany the expedition as naturalist, it is to be hoped that some gain to geography may result.

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WEEDS AS FERTILIZING MATERIAL.

BY CHARLES FREDERICK MILLSPAUGH.

WE have initiated a number of experiments at this station with a view of determining the actual average value of composted weeds as manurial substances upon the basis of the commercial value of their mineral constituents. For this purpose about fifty weeds have so far been gathered in the same manner and at the same time that the farmer should so gather them for compost. Our chemist, Dr. de Roode, finds that each has a certain value according to its species, yielding nitrogen, phosphoric acid, and potash, as seen in the following table, from which we have computed the money values according to the commercial value of the minerals at this place.

Name.	Nitrogen.	Phos. ac.	Potash.	Value.
Poke-weed, *Phytolacca decandra, L.*	3.34	.65	8.00	$21.93
Bitter Dock, *Rumex obtusifolius, L.*	2.94	.50	4.29	16.26
Common Thistle, *Cnicus lanceolatus (L.), Willd.*	2.44	.62	5.53	15.79
Crow-foot Grass, *Panicum sanguinale, L.*	1.89	.90	4.67	13.39
Sheep Sorrel, *Oxalis corniculata v. stricta. (L.), Sav.*	2.04	.61	3.02	12.74
Fox-tail Grass, *Setaria glauca (L.), Beauv.*	1.77	.75	4.52	12.41
Pleurisy-weed, *Asclepias tuberosa, L.*	2.02	.86	3.31	12.35
Sweet Clover, Bokhara Clover, *Melilotus alba, L.*	2.40	.50	1.95	11.87
Burdock, *Arctium lappa, L.*	1.85	.96	3.07	11.69
Ox-eye Daisy, *Chrysanthemum leucanthemum, L.*	2.12	.46	2.88	11.66
Horse-weed, Wild Lettuce, *Lactuca canadensis, L.*	1.07	.47	2.20	11.53
Wild Carrot, *Daucus carota, L.*	1.65	.62	4.21	11.47
Butter-weed, *Lactuca leucophæa (Willd.), Gray.*	2.06	.52	2.89	11.44
Deer-tongue Grass, *Panicum clandestinum, L.*	1.95	.76	2.90	11.44
Blue Thistle, *Echium vulgare, L.*	1.45	.80	4.56	11.35
Iron-weed, *Vernonia noveboracensis (L.), Willd.*	2.07	.42	2.11	10.63
Clot-bur, *Xanthium strumarium, L.*	1.51	.73	3.45	10.43
Climbing Buckwheat, *Polygonum dumetorum, scandens (L.), Gray.*	1.93	.40	2.31	10.38
Yarrow, *Achillea millefolium, L.*	1.71	.50	2.98	10.28
Wild Flax, Toad Flax, *Linaria vulgaris, Mill.*	1.83	.64	2.30	10.27
Lobelia, Indian Tobacco, *Lobelia inflata, L.*	1.79	.65	2.35	10.11
Stickweed, White Devil, *Aster lateriflorus (L.), Britt.*	1.92	.56	1.61	9.80
Briars, *Rubus villosus, Ait.*	1.51	.32	.74	9.68
Wing-Stem, *Actinomeris alternifolia (L.), D.C.*	1.40	.94	2.73	9.55
Old White-top, Velvet-grass, *Holcus lanatus, L.*	1.30	.45	3 72	9.38
Boneset, *Eupatorium perfoliatum, L.*	1.70	.53	1.94	9.23
Timothy, *Phleum pratense, L.*	1.48	.63	2.65	9.21
Milk-Weed, Wild Cotton, *Asclepias Syriaca, L.*	1.71	.93	.78	8.77
Blue Devil, *Aster cordifolius, v. laeviagatus, Porter*	1.49	.52	2 25	8.74
Wild Coreopsis, *Coreopsis tripteris, L.*	1.56	.48	1.54	8.22
Nail-rod, Stick-Weed, *Aster lateriflorus, var. hirsuticaulis, Gr.*	1.47	.49	1.83	8.20
Wire-grass, *Eatonia Pennsylvanica (Spr.) Gray*	1.32	.52	2.26	8.10
Red-top, *Agrostis alba, var. vulgaris (With.) Thurb.*	1.39	.40	2.10	8.02
Quill-weed, Queen-of-Meadow, *Eupatorium purpureum, L.*	1.41	.36	1.81	7.83
Canada Thistle, *Cnicus arvensis (L.), Hoffm.*	2.06	.45	2.74	7.58
Sorrel, *Rumex acetosella, L.*	1.38	.21	1.89	7.47

Indian Hemp, Rheumatism-weed,				
Apocynum androsaemifolium, L.	1.60	.44	.69	7.47
Elders.				
Sambucus canadensis, L.	1.56	.31	1.00	7.41
Rag-weed,				
Ambrosia artemisiaefolia, L.	1.36	.41	1.79	7.32
Goldenrod,				
Solidago juncea, Ait.	1.27	.39	1.62	7.15
Spanish Needles,				
Bidens frondosa, L.	1.24	.32	1.92	7.14
Orchard Grass,				
Dactylis glomerata, L.	.95	.54	2.61	7.08
Naked-weed, Skeleton-weed,				
Chondrilla juncea, L.	1.13	.74	1.27	6.74
Oat-grass,				
Danthonia spicata (L.) Beauv.	1.13	.28	1.77	6.50
Old-field Balsam,				
Gnaphalium obtusifolium, L.	1.04	.41	1.75	6.35
Evening Primrose, Wild Beet,				
Oenothera fruticosa, L.	1.05	.39	1.68	6.29
Blue-joint,				
Andropogon provincialis, Lam.	.73	.24	1.29	4.44
Broom Sedge,				
Andropogon scoparius, Michx.	.78	.21	.68	3.68
Panicled Panic-grass,				
Panicum virgatum, L.	.60	.28	.68	3.40
Average	1.60	.53	2.51	$9.60

It will be seen, that, if this is a fair number of species to draw conclusions from, weeds properly composted should be worth $9.60 per ton. These values are of course computed upon a water-free basis, while the farmer would gather with his weeds about 50 per cent of their weight in water. We have, however, proved that proper composting, especially with the addition of lime, rots and kills all the seeds of the weeds gathered; and argue that, if the farmer thus removes the weeds from his lands and roadsides, thereby decreasing the annual production and continued presence of the same, that if he thus relieves his fields of the trash, giving more room for good, clean grass, that if he places upon his cultivable ground the humus that it would otherwise never receive, that if he is thus taught to utilize all such matter as has heretofore gone to waste upon his farm and in his ditches and roads, this compost would be raised by these profitable issues to the full value of the dry material as given above.

W. Va. Agr. Exp. Station.

NOTES ON LOCAL MEMBRACIDÆ AND FULGORIDÆ.

BY E. B. SOUTHWICK, PH.D.

IN the MEMBRACIDÆ, the sub-family DARNINÆ is represented by *Ophiderma salamandra* Fairne., which with us is very rare. *Ophiderma mera* Say and *O. arcuata* Say are both recorded from New Jersey, and Fitch records *mera* as occurring in New York and feeding on the butternut.

In the sub-family SMILIINÆ we have several species, *Acutalis tartaria* Say being quite common and very variable in coloration, some of them being nearly black. *Acutalis calva* Say is much smaller and exceedingly rare.

Telamona ampelopsidis Harr. is represented by half a dozen specimens. It is quite rare. A friend informs me that a few years ago he found it very common on Ampelopsis in this city. I have one specimen of what is labeled *Tragopa calva* Say. It is shaped very much like *T. ampelopsidis* Harr., save that the apex of the hump is more narrow I have not taken any other species of *Telamona*, although several are recorded from New Jersey and New York.

Thelia is represented by *bimaculata* Fabr. It is rare, and but two specimens were taken, both from elder (*Sambucus*).

Ceresa is represented by three species: *brevicornis* Fitch, *bubulus* Fabr., and *diceros* Say, the latter being very rare, and the other two species common.

Stictocephala festina Say is very common and very uniform in size. *S. festina* Say I have never taken, although it should occur with us.

In the sub-family HOPLOPHORINÆ I have never taken a representative species. But *Plotycoris quadrivittata* Say and *P. vittata* Fabr. are both recorded from New Jersey, and should occur here also.

In the sub-family MEMBRACINÆ, *Enchenopa binotata* Say is very common indeed. I have taken it from the butternut, Viburnum; New Jersey tea (*Ceanothus*), bittersweet (*Celastris*), and white birch. *Ptelea*, grape, *Cercis*, and locust are also given as its food-plants. On *Ceanothus* it is very abundant in all stages of transformation, and a species of black ant is very attentive to it in the pupa state, no doubt obtaining from it honey-dew, as in the case of Aphides. When disturbed they become formidable enemies and bite one's hand very severely.

Enchenopa curvata Fabr., now known as *Campylenchia curvata* Fabr., is exceedingly common; and the length of the projection of the thorax, for a long time, led me to believe there were two species. But Professor Van Duzee says they are one and the same species; that is, those with the long, curved thorax and those with the short and less curved thorax.

In the family FULGORIDÆ and sub-family CIXIINÆ I have one species of *Phypia* not known to Professor Van Duzee. *Cixius stigmatus* Say is very rare, or at least is so very delicate as to be easily torn and unnoticeable, which may account for its scarcity in my collection.

Otiocerus Degeerii Kirby is represented by a single pair. This is a very curious, as well as beautiful insect, with its long fore-wings widening out like a fan at the ends.

In the sub-family DITYOPHORINÆ we have *Scolops sulcipes* Say and *S. angustatus* Uhl., the former a common species and the latter quite rare. *Monopsis tabida* Spin. I have never taken, but it probably occurs here.

In the sub-families ISSINÆ and CALOSCELINÆ I have never taken a single representative species. But, in the sub-family FLATINÆ, *Ormenis pruinosa* Say and *O. septentrionalis* Spin. are very common. *Pruinosa* has formerly been known as *Flata pruinosa* and *Poeciloptera pruinosa* Say. This insect is common on the white birch; but I have taken it from the elm and maple, more particularly from the young sprouts. Dr. Riley records it as feeding on red clover, *Erigeron canadensis*, and quite a number of other plants and shrubs, not specified; and Dr. Fitch records it as occurring on the gooseberry and rhubarb. It is quite a general feeder, but with us it seems to affect the white birch most. Dr. Fitch also mentions its occurrence on the privet in New York, but I have never discovered it on this shrub, although it is everywhere abundant in Central Park.

Amphiscepa bivitata Say is very common with us; but I have not as yet, from my own observation, found out what plant it feeds upon most, as the sweep-net gathers it from grasses and weeds alike.

THE TEXAS ACADEMY OF SCIENCE.[1]

BY DR. EVERHART.

FOR some time past there has been a feeling on the part of some of those here present that the time was ripe for the formation of a Scientific Association in this State. This feeling needed but a word to find expression of approval and to inaugurate the movement. This word was spoken a little over a month ago, and immediate steps were taken to bring about the present result. The professors of science, natural and exact, in this university, held an informal meeting in the early part of January and decided to send to various men engaged or interested in scientific work in Texas invitations to meet here on the ninth of January for the purpose of organizing a Scientific Society. These invitations met with a most cordial response from everyone. The meeting was held at the time named and organization perfected.

The plan and scope of the Texas Academy of Science are intended to be somewhat similar to those of the National Academy of Sciences at Washington.

As will be seen in the constitution already adopted, the object of the academy is threefold. In the first place it is intended that an opportunity should be given to the scientists of the State to have personal intercourse with each other, to exchange ideas, and to discuss scientific questions of the day. Were this the only object of the academy, still its organization would be well worth the effort, for by this personal intercourse between men of different or kindred pursuits, and by this interchange of thought, and by the consequent regarding various questions from many different standpoints, men become less rusty in those branches of science other than their own, they become more tolerant of the opinions of others, and are compelled to leave those ruts fostered by isolation and freedom from contradiction. To the teacher especially is this feature of the academy valuable. He, necessarily, has always to speak ex cathedra. In presenting subjects to his classes he is lawyer, judge, and jury. To such a man discussions with his equals are a necessity. It is urged upon the members of this academy, therefore, that they not only contribute to its success by scientific papers, but that they will also further its aims and their own advantage by attendance on the meetings.

The second object of this association is to investigate and report on any subject pertaining to the natural or exact sciences, when called upon by any of the departments of the State government. It is intended that this should always occupy a prominent place among the objects of the academy. Apart from our obligations as citizens of Texas, many, perhaps even the majority of us, are particularly indebted to the State. The furthering of her interests, therefore, is of paramount importance, and the development of her resources will promote not only her welfare, but also the welfare of science. We trust that in the near future this Academy of Science will be legally recognized by the State, and that a union profitable to both will be consummated.

The chief idea, however, in forming this association is the promotion of science, natural and exact. To this end it is contemplated that at all regular meetings of the academy original papers or well-digested reports on scientific topics will be presented and discussed. With the present membership, and with the present status of science in Texas, it can hardly be expected that original memoirs will always be on hand, still if the members of the academy will interest themselves in its aims, there is no reason to doubt that we will have during the course of each year at least a respectable number of valuable contributions to science. Our incentives to this desirable result are our duty to the academy, to Texas, and to science.

The chief aims of this organization are, I repeat, the cultivation and promotion of science. By science I mean true science, the search after truth in nature. Science in its practical applications will have no difficulty in finding followers; the question of how much money a scientific law or fact will produce is the prime object of the many, but there is a much more exalted side of science, and it is to this side that I invite your attention for a few moments.

I do not mean to depreciate the motives or the usefulness of those who devote their time and energy to the practical utilization of science in our everyday life, but I do mean that there is something higher and nobler than that in science, and that the one who cultivates this side of science has the nobler aim in life. The true scientist is not restricted by the narrow limits of practical utility; his domain is wider and his investigations freer. The discovery of a new law in science can not be measured by money; its influence is exerted on all mankind and lasts forever. In the past century many scientific laws have been discovered, any one of which has done more towards the amelioration of the lot of man than all the alms and charities since the beginning of time.

The practical scientific man is always the follower of his master in theoretical or pure science, and is entirely dependent on the latter for his inventions. There have been given but few inventions to the world that were not based on previous discoveries made by men who neither expected nor cared to make money out of their chosen science. The practical scientist adapts laws to commercial purposes, but he never discovers laws.

One sometimes reads of indexes of civilization and prosperity proposed for various nations. For example, an English writer has said that the civilization of a land might be measured by the amount of sulphuric acid it manufactures. Another has proposed iron, still another soap, as an index, but it strikes me that the civilization and progress of a country may be much more accurately gauged by the amount of attention it pays to pure science. There is no doubt but that Germany stands at the head of all nations in practical science of all kinds, and equally certain is it that no country is so thoroughly impregnated with a pure scientific spirit or is so prolific of men who devote their lives to science in its highest aspects. These are the men who really give to the world those ideas the practical utilization of which has given us our present advancement. These men may be but little known except to students. How many of us, for instance, know even by name Kolbe, Lothar Meyer, Hofmann, Kekule, Wislicenus, or Ostwald? Yet these chemists, by their discoveries, have opened and are now opening vast avenues to trade and commerce and otherwise contributing to the welfare of their fellow-men. These are the real benefactors of mankind, and their example should be emulated by all scientists who have the love of science in their hearts. There is no nobler life than that of a man who devotes himself to science. It is unselfish, it is a search after truth, and it benefits mankind. No higher attributes can be assigned to any other calling.

Very often one is asked what this or that experiment is good for. It is sometimes difficult to make the questioner

[1] Introductory Address, by Dr. Everhart, President of the Academy, Feb. 8, 1892.

comprehend that although there may be no apparent money value in the investigation, still it has a scientific value. The scientist in an investigation rarely thinks of its practical application, yet some of the greatest godsends to the human race have resulted from these theoretical researches. For example, medicine would have no knowledge of chloroform, ether, acetanilide, antipyrin, potassium bromide, and countless other equally valuable preparations, were it not that these substances were discovered during theoretical investigations. Again, when Faraday was working on the bad-smelling, dirty-looking coal-tar, who ordinarily would have supposed that his isolating from this unpromising substance benzine and some of its derivatives would revolutionize many industries and inaugurate others that now have a capitalization of millions and millions of dollars? Faraday's researches rendered possible the coal-tar color industry.

Numberless instances of the practical value of theoretical investigations might be given, but the above will suffice.

There is, perhaps, a popular prejudice against the scientific man. This prejudice was formerly directed against mathematicians only, but is now being extended to other scientists. There is no outcry against them, but their advice and conclusions are often thought inferior to those of the so-called practical man. Unfortunately for the pockets of these people confiding in the judgment of the practical or rule-of-thumb man, their ventures nearly always come to grief. I believe that the amount of money lost in this way, even during the last twenty years, amounts to more than the national debt. This popular idea is due entirely to ignorance and to unfamiliarity with science and scientific men and methods. It is hoped that this Academy of Science will be able, both directly and indirectly, to help educate the people to put their confidence in those that are worthy of it. When this is brought about we will no longer have companies organized to make a Keely motor, nor to refine sugar by electricity, nor will we have men digging for gold in every rock, or looking for bituminous coal in alluvial formations.

I believe that with these aims before us we can make the academy a success and a benefit to science. Texas has ample and first-class material in her young men for the making of future scientists, both pure and practical. We should encourage by every means in our power the study and prosecution of the exact and natural sciences, because, no matter what may be said to the contrary, on them rest our comfort, our welfare, our progress, physically, mentally, morally.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

Causes which Produce Cold, and Mild Periods.

IN *Science* for Aug. 21 and Feb. 19, I pointed out what I conceived to be the cause of the frigid and warm periods. Still, in order to make my views more plain, further explanation, and repeating, may be necessary.

The tropical surface-waters of the ocean when moved into the high latitudes in large volumes, thus adding their warmth to the heat imparted by the sun, are undoubtedly able to cause a mild climate. This is the opinion of most writers on climatic changes. Still, it seems to me, while viewing the subject from a marine standpoint, that they have only partly comprehended the manner in which the ocean waters are moved in a latitudinal direction. Consequently, their explanations have never proved satisfactory to those who have considered the subject. The only way in which tropical waters are moved into the high latitudes, in quantities sufficient to cause a mild climate, is through the force of the great prevailing winds of the globe. These winds, as is well known, blow mostly from the east towards the west in the tropics, and from the west towards the east in the high latitudes. This counter-movement of the winds, in connection with land of great latitudinal extent, like the western continent, is able to move the tropical waters far into the northern and southern seas. But in order to do such work perfectly, the land should extend unbroken from the Arctic to the Antarctic circles; because, under such conditions, the westerly winds would blow the surface-waters of the ocean away from the eastern shores in the high latitudes, and so cause extensive low sea-levels, while the easterly winds of the torrid zone would heap the ocean waters against the tropical shores of the continent. Consequently, the warm waters of the tropical high sea-level would be moved by gravitation to the low sea-levels of the high latitudes, even to the Arctic and Antarctic regions, and thus afford them a mild climate. In this way we account for the mild climates enjoyed by the temperate and polar regions during early ages. For it is probable that during such times the wide channel of comparatively shoal water, which now separates the western continent from the Antarctic shores, was a region of low land, and the channels leading into Baffins Bay and Davis Strait were also closed. But since the Tertiary period the low land that connected Cape Horn with the southern continent has been flowed by the sea; which may have been caused through a tendency of the ocean waters southward, or a comparatively small movement in the earth's crust. This flowed region as now represented increases in depth from its northern and southern shores to 1,000 fathoms in its middle portion. The channel has probably been greatly deepened since its first flowage, through the scouring of ice-sheets for thousands of years of successive ice-periods; and it is owing to its waters separating the Antarctic shores from South America that prevents the strong westerly winds of that region from creating a low sea-level in the high southern latitudes. Therefore, the waters of the torrid zone heaped against the South American coast by the trade-winds are not at this date attracted far into the southern seas. It is true they flow along the coast of Brazil to an inferior low sea-level, caused by the westerly winds blowing the surface-waters away from the coasts of Argentine and Patagonia, but on gaining that region they are met by the cold currents which pass through the channels opening into the Pacific, and so turned away from the more southern latitudes. The westerly winds further south, owing to the Cape Horn channel being open, cause, as I have before explained, a drift current to extend around the southern portion of the globe, which largely turns away all tropical currents setting southward. And it is through this exclusion of tropical waters from the high southern latitudes, ice-sheets have been able to gather and will continue to gather on the southern continent and extend into its shallow seas, until the channel separating the western continent from the Antarctic lands is closed. The closing of this channel with ice is only a question of time should the snowfall of that region continue to be as great as it is now.

The Antarctic ice-sheet may have been over ten thousand years in gaining its present extent and thickness, and it may require as much, or more, time to perfect it. Yet it is probable that the larger portion of its coast-line cannot be extended seaward, on account of the great depth of the ocean bordering its shores. But where the water is comparatively shoal the ice-sheet must advance until all the neighboring shallow seas and channels are filled, and a broad isthmus of ice connects the Antarctic lands with the western continent. This being perfected, the strong westerly winds of the southern latitudes will blow the surface-waters away from the Atlantic side of the isthmus, and so cause an extensive low sea-level sufficient to attract the tropical waters from the high sea levels abreast Brazil and the east coast of Africa well into the southern ocean, and thus cause in time a mild climate in the Antarctic regions, as I have before pointed out.

In the northern latitudes we see the Arctic channels severing the western continent from the more northern lands; and it is

through these passages the Arctic currents flow and largely occupy the low sea-level, caused by the westerly winds along the American coast from Greenland to Florida. We also see the tropical waters heaped against Mexico, attracted to the same low sea-level, thus causing the Gulf Stream. But the waters of this stream, while on their northern passage, are so obstructed by the opposing Arctic currents, they fail to reach the higher northern latitudes; consequently heavy glaciers have gathered and still are gathering on Greenland and other Arctic shores, and this increase of cold will continue in unison with the growing cold of the Antarctic regions until the Arctic channels are closed with ice, and a northern ice-age completed. But when the Arctic channels are closed, the Gulf Stream will be able to reach a much higher latitude than now, as it would meet with no obstruction except the return current of its own waters, which would probably flow down the east coast of Greenland, where the Arctic waters now flow. Thus, with less obstruction, the movement of tropical waters into the Arctic regions, which, in connection with increasing warmth in the southern hemisphere, would be able to bring about a warm period in the northern latitudes of considerable duration, on account of the glaciers filling the Arctic straits being situated to the windward of the tropical currents, and, in consequence of their cold location, would be the last ice to melt in the northern regions.

It has been the opinion of several writers that should the whole of the warm Gulf Stream water flow into the Arctic Ocean it would probably remove the ice of Greenland, and it is reasonable to suppose that such would be the case. But, as far as I know, such theorists always fail to explain how tropical waters are ever made to flow into the high latitudes. They have nothing to say of the low sea-level trough, caused by the westerly winds, extending from Georgia to Greenland, and thus attracting both the Arctic and Gulf-stream waters in opposite directions over fifteen hundred miles along the American Coast. For were it not for this low sea-level the Gulf Stream would not be able to move so far northward as it now flows, but would spread out, were the Atlantic a level plain, and become a drift current much further southward; especially with the Arctic currents opposing it from the north.

Professor Geikie asserts that there can be no doubt whatever that periods succeeding the Tertiary have been characterized by great oscillations of climate — extremely cold and very genial conditions alternating; and that during the frigid period, where we now have the greatest rainfall, the greatest snowfall took place. He also says, that during such times changes in the relative level of the land and sea had taken place. But he did not believe that there had been any great movement in the earth's crust. For while giving his views on the earth-movement hypothesis he declared that there was not the least evidence of great continental elevations in the northern hemisphere, and even if such improbable earth-movements were admitted they would not account for the glacial period. The assertions of Professor Geikie, that where we now have the greatest rainfall, in glacial times the greatest snowfall took place, shows that the prevailing winds during the cold period must have blown in the same direction they now blow. Consequently, the great ocean currents, being governed by the prevailing winds, were during the glacial period moving in the same direction they now move. But the great Southern Ocean drift current lost its independent movement when the Cape Horn channel was closed with ice; which, according to the common course of nature must again be brought about. Thus, in the future, as in past glacial periods, the strong westerly winds that sweep the Southern Ocean would blow the surface waters away from the leeward side of the ice isthmus and so cause a low ocean-level; and it appears that the only water that could be attracted to this low sea-level would be the tropical water heaped against Brazil by the trade-winds. This tropical water on gaining the low ocean-level would spread over its wide depression, where the westerly winds would cause it to become a drift current, and in this way it would be moved along the shores of the Antarctic continent past the South Indian and South Pacific oceans and eventually be forced against the Pacific side of the ice isthmus and Patagonian coast, and so cause a high ocean-level. This high level would vastly increase the volume of the Humboldt current, which would flow, as it now flows, down the South American coast to the equatorial latitudes, where it would become the main source of the great equatorial current. The latter current with an increased volume would also move as it moves to-day, across the Pacific, and through the East India passages into the Indian Ocean, where it would flow on partly as a drift current until it joined the great Mozambique current, which would flow southward along the east coast of Africa, the same as it now flows. At this age, when this continuation of the great equatorial stream gains the latitude of the Cape of Good Hope, its waters are largely turned eastward by the great drift current of the Southern Ocean; but a considerable portion of its waters turn towards the west forming the Agulhas current, which flows around the Cape of Good Hope into the Atlantic, where it mingles with the cooler currents, which branch off from the great southern drift current; and so in connection with the latter waters is moved by the south-east trade-winds towards the equatorial Atlantic and coast of Brazil. Thus it will be seen that the Agulhas current, while giving additional warmth to the Atlantic, serves to retard somewhat the advance of the coming cold period.

The Agulhas current also partly serves to replenish the water which at this date is forced from the South Atlantic by the strong westerly winds into the southern Indian and Pacific oceans. For it appears that more water is now removed by such winds from the South Atlantic than enters it from the Cape Horn channel. This channel being less than half of the breadth of the westerly wind-belt of the Southern Ocean, the drift currents do not all pass through it from the Pacific into the Atlantic. Consequently, a considerable portion of the drifting water turns northward west of Cape Horn, and so forms the Humboldt current. Therefore, the Agulhas stream, which even now assists in replenishing the Atlantic, would be a much stronger current with the Cape Horn channel closed; because the South Atlantic waters would continue as now to be forced eastward by the strong westerly winds, yet they could not be replenished as they are to-day directly from the Pacific; therefore, the waters of the whole Atlantic Ocean would be correspondingly reduced. Such conditions alone would greatly swell the warm Agulhas stream at the culmination of a frigid period, and thus greatly assist the Atlantic in its operations while bringing about a warm period. Dr. Croll, in his astronomical theory, declares the ice periods of the northern and southern hemispheres to be consecutive. But when we consider the wide connection and circulation of the tropical seas it seems impossible for a glacial epoch to be perfected in one of the hemispheres with a mild climate extending over the opposite portion of the globe. And it appears to me that the tropical lands I have visited show indications of having at times experienced a temperature sufficiently cold for snow and ice to have gathered on their highlands, and in some locations glaciers may have extended to the sea. Besides it is well known that Alpine plants exist on the high mountains of the tropics; and it also appears that during some ancient period the climate has been favorable for their crossing the lower lands of the torrid zone, which tends to show that the frigid periods of the two hemispheres were concurrent.

C. A. M. TABER.

Wakefield, Mass., June 13.

European Origin of the White Race.

I HAVE received so many letters questioning my statement in *Science*, March 25, that Omalius d'Halloy, and not Dr. Latham, was the first to maintain the European origin of the white race, that it seems due to the former scientist, as well as to myself, to quote his words. Even such a thorough-paced archæologist as M. Salomon Reinach, of the National Museum, St. Germain-en-Laye, writes: "Where did you hear that Omalius had presented the European theory before Latham? I am sure that it is not so."

Now if these inquirers will turn to the Bulletins de l'Academie Royale de Belgique, Tome XV., No. 5, May, 1848, they will find an article of 16 pages, entitled "Observations sur la Distribution ancienne des Peuples de la Race blanche," par M. J. J. Omalius

d'Halloy, beginning with this sentence: "Dans une série de notes que j'ai présentées à l'Académie de 1839 à 1844, j'ai cherché à faire voir, entre autres considerations ethnographiques, que la race blanche, restreinte dans ce que je considère ses véritables limites, présente trois modifications principales, *et qu'il n'est nullement démontré que les ancêtres des Européens actuels soient venus d'Asie.*" (Italics mine.)

The author then proceeds to discuss the evidence, physiological, historical and linguistic, which had been thought to show that the Indo-European peoples originated in Asia; and combats it at every point, marshalling his arguments to prove that the true white type is distinctly European; and that the ancient Sanscrit and Zend are in no wise maternal languages of the Indo-European stock, but merely sisters of the Greek, Latin, and ancient German.

The earliest expression of this view by Dr. Latham, so far as I know, is that referred to by Professor Haynes, in this journal, April 8, which was published in 1851,—years, therefore, after Omalius had urged the same theory in a number of papers. It is strange. indeed, and regrettable, that an endless chain of writers have given credit where it did not belong for this bold and certainly in great measure correct theory. D. G. BRINTON.

Media, Pa., June 20.

AMONG THE PUBLISHERS.

PROFESSOR HUXLEY is collecting his papers on the "Gadarene Swine" and other controversial topics, which he contributed recently to the *Nineteenth Century*, and will issue them with a new preface.

—Fleming H. Revell Company has just ready "Peeps into China," by the Rev. Gilbert Reid, M.A., of the American Presbyterian Board, a series of observations on the manners and customs of the Chinese.

—G. P. Putnam's Sons have ready "Materialism and Modern Physiology of the Nervous System," by Dr. William H. Thomson, Professor of Materia Medica in the University of New York; and "Who Pays Your Taxes?" a compilation by Bolton Hall of the opinions on taxation of David A. Wells, George H. Andrews, Thomas G. Shearman, Julien T. Davies, Joseph Dana Miller, the compiler and others, which is one of the "Questions of the Day Series."

—Ginn & Co. have in preparation "A Students' Edition of the Age of Fable," on the basis of Bulfinch's "Age of Fable" (1855), adapted to school use and to the needs of beginners in English literature and in the classics, in part rewritten, accompanied by interpretative and illustrative notes, by Charles Mills Gayley, Professor of the English Language and Literature in the University of California, and formerly Assistant Professor of Latin in the University of Michigan.

—Longmans, Green & Co. will publish immediately a new edition of Professor Max Müller's lectures on "India: What can it Teach Us?" which were delivered at Cambridge to the candidates for the Indian Civil Service. They will bring out at the same time a new edition of the first volume of Professor Max Müller's "Gifford Lectures," on "Natural Religion," delivered at Glasgow in 1889. Professor Max Müller is preparing for the press the fourth volume of his "Gifford Lectures," on "Psychological Religion," but it is not likely to appear before the end of the year.

—Messrs. D. Appleton & Co. announce for early publication "Controverted Questions," a new book by Professor Huxley; "The Principles of Ethics," Vol. I., by Herbert Spencer; "The Canadian Guide-Book, Part II., Western Canada," a handsomely illustrated volume by Ernest Ingersoll, describing Western Canada from Ottawa to Vancouver, and uniform with "The Canadian Guide-Book, Part I., Eastern Canada," by Professor C. G. D. Roberts, of which a new and revised edition is now ready; "The Naturalist in La Plata," illustrated by W. H. Hudson, joint author of "Argentine Ornithology." New editions, fully revised, of Appletons' well-known "General Guide to the United States and Canada," and "Appletons' Summer Resorts," are to be published immediately.

—Mr. C. Michie Smith has edited a work embodying "Results of the Meteorological Observations made at the Government Observatory, Madras, during the years 1861-90, under the direction of the late Mr. Norman Robert Pogson." The volume, according to *Nature*, is published by order of the Government of Madras. It was Mr. Pogson's intention to issue the work as soon as he could after the completion of thirty years of observation, and at the time of his death a considerable part of the manuscript was nearly ready for press. In editing the work, Mr. Smith, so far as possible, has retained the original plan. He expresses much admiration for the skill and thoroughness with which the observations were organized and carried out.

—In the *Political Science Quarterly* for June Professor John Bassett Moore continues his study of "Asylum in Consulates and in Vessels," bringing it down to the late affair in Chili; John Hawks Noble presents a concise summary of "The Immigration Question" as it stands at present; Robt. Brown, Jr., gives the salient points in the history of "Tithes in England and Wales;" Professor Ugo Rabbeno, of Bologna, Italy, expounds and criticises "The Landed System of Social Economy," as contained in the works of his fellow-countryman, Achille Loria; Ernest W. Clement discusses "Local Self-Government in Japan;" and Professor A. B. Hart, of Harvard, writing on "The Exercise of the Suffrage," argues against the project of compulsory voting and gives statistical tables bearing on the subject. The book reviews include over twenty publications, and Professor Dunning brings his Record of Political Events down to May 1.

—C W. Bardeen of Syracuse, N. Y., has published a little pamphlet by Professor N. M. Butler on "The Place of Comenius in the History of Education." It does not sketch the incidents of Comenius's life, and gives only a partial account of his educational theories, the defective parts of his work being for the most part kept out of sight. Comenius held certain notions about the matter and manner of teaching of which Professor Butler himself is a strong partisan, and he is glorified in this pamphlet accordingly. Indeed, our author would have us believe that nearly all those views and practices that go by the indefinite name of "the new education" were anticipated by the Moravian educator who was born three centuries ago. Yet when we come down to facts, we find that his anticipations were often very vague, while many of the ideas he held, and on which Mr. Butler lays much stress, are at the present day little better than fads. The point most insisted upon by Mr. Butler is that Comenius was the first to maintain that education is, or should be, a drawing out and developing of the faculties. But surely that idea is expressed in the etymology of the word *education*, a fact which proves that the idea is very old. Comenius holds an honorable place in educational history, but he was no such paragon as Mr. Butler would have us believe.

—The Clarendon Press, says *Nature*, will publish immediately a second volume of Professor Weismann's work on "Heredity and Kindred Biological Problems." It contains four essays, of which only the shortest has previously appeared in an English form (in the columns of *Nature*). The first essay deals with degeneration, and clearly shows by abundant illustrations that it has resulted from *panmixia*, or the cessation of natural selection. The second is an attempt to explain the development of the art of music, and to show that the hereditary transmission of the results of practice is quite unnecessary in order to account for its rise. The third contains a reply to certain objections urged by Professor Vines. It will be useful in giving clearer expression to the ideas on the death of multicellular beings and the immortality of the unicellular. The fourth and last essay is by far the longest and most important. It deals with the essential significance of sexual reproduction and conjugation, etc., as inferred from the results of the most recent researches. Professor Weismann's older views on these subjects, especially concerning the polar bodies, have been modified and in part abandoned. The immortality of unicellular beings and the question of the transmission of

acquired characters by them are also discussed in detail with reference to recent observations.

— We learn from *Nature* that Mr. R. H. Scott has contributed an article entitled "Notes on the Climate of the British Isles," to *Longman's Magazine*. The author gives some amusing instances of the distortion of facts at seaside stations, where the observers are anxious to prove the advantages of their own towns over those of their rivals. Taking the whole year round, the warmest spot is the Scilly Isles, which are a degree warmer than either the west of Cornwall or the Channel Islands; while the coldest region on the coast is the extreme north-east of Aberdeenshire. In winter very little difference of temperature is met with all along the east coast; but the coldest part of England lies round the Wash. With regard to the variability of temperature, or the difference of the mean temperature of an entire day, the equability of the temperature of these islands is very great. The only locality for which a more uniform temperature has yet been published is Georgetown, Demerara; the figure for this place is 1.1°, while for London is 2.7°. All the great changes of temperature occur in winter, and accompany sudden thaws. As regards bright sunshine, the Channel Islands are by far the most favored. On the mean of the whole year Jersey secures 39 per cent; but from the Bristol Channel to the coast of Norfolk there is but little difference in the amounts recorded. In cities like London the deficiency is due to smoke. The statistics relating to fog are not yet completely discussed, but so far as they go they show that in winter the foggiest district is the east coast of England. Next come London and Oxford, which are about equal. With regard to rainfall the east coast stations receive on an average of the whole year about half as much as those on the west coast, the amount being about 25 inches on the east coast, 30 to 40 inches between Sussex and Devonshire, and fifty inches to the south of Cornwall. In the west of Ireland the amount rises to 70 or 80 inches, owing to high land near the coast. The driest hour almost everywhere is noon.

— No document can give a better account of an Indian's acts or mode of thinking than a document composed by himself and put down correctly in his own words and language. In describing Indian feats of war, council debates, or stories, the author of the white race feels perfectly dwarfed when he compares his account to the phraseology of the Indian, who, with a few powerful strokes of the tongue, tells us much more accurately and forcibly what he intends to convey to our minds about his people. The numerous myths, stories, and historic recitals published in James A. Dorsey's new volume ("The Dhegiha Language," 18 and 794 pp., Washington, 1890, quarto) will fully bear out this statement. The author has made accessible to us the Omaha and Ponka language, not only by publishing the Indian texts as dictated to him by the natives and adding to them a readable English translation, but he has also subjoined an interlinear translation for each Indian

Publications Received at Editor's Office.

DOLBEAR, A. E. Matter, Ether and Motion. Boston, Lee & Shepard. 12°. 342 p. $1.75.
FLETCHER, L. The Optical Indicatrix. London, Henry Frowde. New York, Macmillan & Co. 8°. 124 p.
HATCH, F. H. Mineralogy. London, Whittaker & Co. 12°. 182 p. $1.
MISSOURI BOTANICAL GARDEN. Annual Report, 1892. The Trustees. 8°. 170 p.
TROY, DANIEL S. The Value of Money. Montgomery, Ala., Brown Printing Co. 8°. Paper. 26 p.
YEAR-BOOK of the Scientific and Learned Societies of Great Britain and Ireland. London, Charles Griffin & Co. 8°. 239 p.

word, as it occurs in the sentence. This enables us to study that dialect with comparative ease, and opens to us the innermost soul-life, the very fabric of Indian thought, by the disclosure of the grammatic elements. To these Indians, the categories of number and tense are not very material, and that of sex is never marked as such; but it is quite important to them whether the object spoken of or the acting subject is visible or invisible, close by, further off, or at a great distance. It matters little to these Indians of what special appearance the subject or object is, but they have to express with accuracy, whether it was standing or sitting, reclining or stretched out, acting on purpose or without purpose, and whether those acting were acting singly, in a small body, or in a crowd. Whether a story-teller is relating a fact from his own knowledge or from hearsay, has to be distinctly stated in every one of his sentences, and from the term here used it also becomes apparent whether he has heard the statement from one person or from several authorities. Although Dorsey's contributors have related to him many tribal events which we would call traditional history, we feel in reading them that they are based on historical facts and truly Indian sociological conditions, and, as such, are just as valuable to us as many facts recorded by official historiographers of the white race. What we need for their understanding is a profound and not a desultory study of these and other Indian pieces of oral literature. Students to whom the volume has not been sent should apply for it to the member of their congressional constituency.

—The following are from the table of contents of the July number of *The Chautauquan*: Overland by the Southern Pacific, by Fannie C. W. Barbour; Hay Fever as an Idiosyncrasy, by J. M. Cooper, M.D.; In the Snake River Valley, Part II., by John R. Spears; Historic Quebec, by Edith Sessions Tupper; Summer Vacations and Physical Culture, by J. M. Buckley; The Beginnings and Endings of Centuries, by Count Charles de Mouy; Some American Chemists, by Marcus Benjamin; The Great Exposition at Chicago, by Noble Canby; Why American Children are Nervous, by Mrs. L. E Chittenden; Marriage in Nanking, by Harriet Linn Beebe.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwich, Arthur E., Montclair, N.J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Cragin, F. W., Colorado Springs, Col.
Davis, W. M., Harvard College, Cambridge, Mass.
Dimmock, George, Canobie Lake, N.H.
Farrington, E. H., Agricultural Station, Champaign, Ill.
Ferree, Barr, New York City.
Flexner, Simon, Johns Hopkins University, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Museum of Comp. Zool., Cambridge, Mass.
Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutgers College, New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
Hazen, H. A., Weather Bureau, Washington, D.C.
Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
Hitchcock, Romyn, Washington, D.C.
Hotchkiss, Jed., Staunton, Va.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
James, Joseph F., Agricultural Dept., Washington, D.C.
Johnson, Roger B., Miami University, Oxford, O.
Kellerman, Mrs. W. A., Columbus, O.
Kellicott, D. S., State University, Columbus, O.
Macloskie, G., Princeton, N.J.
McCarthy, Gerald, Agricultural Station, Raleigh, N.C.
MacDonald, Arthur, Washington, D.C.
Marshall, D. T., Metuchen, N.J.
Mason, O. T., Smithsonian Institution, Washington, D.C.
Nichols, C. F., Boston, Mass.
Nuttall, George H. F., Johns Hopkins University, Baltimore, Md.
Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Ruffner, W. H., Lexington, Va.
Schufeldt, R. W., Washington, D.C.
Scripture, E. W., Clark University, Worcester, Mass.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers College, New Brunswick, N.J.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., National Museum, Washington, D.C.
Turner, C. H., University of Cincinnati, Cincinnati, O.
Ward, R. DeC., Harvard University, Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard University, Washington, D.C.
Welch, Wm. H., Johns Hopkins University, Baltimore, M.D.
West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.